

# **Opening New Frontiers in Computational Science**

## **Allocations and Usage at the National Energy Research Scientific Computing Center**

The National Energy Research Scientific Computing Center (NERSC) was established in 1974 as the nation's first unclassified supercomputer center accessible to a nationwide user community. The vision was to provide the most powerful computing resources available to fusion researchers across the country. Through the years, the mission has been broadened to support an increasingly wider range of scientific research.

### **What is NERSC?**

NERSC is a national computing facility that is open to researchers from both national laboratories and universities, with fewer restrictions than any other national computing center. As one of the nation's most powerful computing resources, and a world leader in scientific computation, NERSC's mission is to accelerate the pace of scientific discovery, particularly within the Department of Energy's Office of Science community, by providing high-performance computing and information services.

As America's first supercomputer center to support a nationwide user base, and the model for those that followed, NERSC has a 25-year history of innovation. NERSC pioneered many of the supercomputing practices taken for granted today, including remote access, time sharing, interactive use, multitasking, high performance data storage and retrieval, high performance networking, on-line documentation, 24-hour support for users, and intellectual resources. At the same time, NERSC has consistently provided its users with some of the most powerful and advanced supercomputers available anywhere. NERSC has a threefold strategy for increasing researchers' productivity:

1. Provide leading-edge platforms which, together with first-class system management and user support, make NERSC the nation's foremost resource for large-scale computation.
2. Introduce the best new computer science tools to researchers.
3. Provide intellectual services (for example, development of innovative algorithms, simulations, and visualization techniques) that make these complicated technologies useful for computational science.

NERSC is a national user facility operated by the NERSC Division of the Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab). The Division also carries out research in applied mathematics and computer science to benefit the nation's high-performance computing community. The NERSC high-performance computing facility is funded by the U.S. Department of Energy (DOE), Office of Science, Office of Advanced Scientific Computing Research (OASCR), Mathematical, Information, and Computational Sciences Division (MICS). NERSC is the principal provider of high performance computing services to laboratory and university researchers whose work is funded by DOE Office of Science programs — Magnetic Fusion Energy, High Energy and Nuclear Physics, Basic Energy Sciences, Health and Environmental Research, and Computational and Technology Research.

## **Who can use NERSC?**

Any researcher at a university or a federal research laboratory in the United States can apply for access to NERSC's resources via one of two paths.

The first path is to apply to the appropriate scientific program office in DOE's Office of Science for a grant or contract for research. Applications for DOE grants or contracts must be relevant to the DOE mission and go through peer review managed by its program officers. Researchers with DOE grants from the Office of Science are allocated computer time annually by a committee of program officers according to their computing needs and the amount of time available at NERSC.

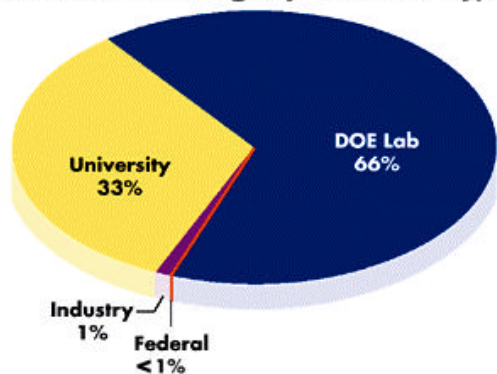
The second path is to apply directly to NERSC via its web-based application form (<http://hpcf.nersc.gov/accounts/allocations/>). Applications from researchers at universities or federal research laboratories who do not have grants from the Office of Science compete for computing resources in a peer review process. DOE program managers judge whether the proposed work is mission-relevant for the agency. The peer review is then conducted separately by the NERSC Program Advisory Committee, which consists of scientists representing the range of scientific disciplines served by NERSC.

The NERSC allocation process brings world-class scientific users to the NERSC facility from both national laboratories and universities. The success of the open competition for resources at NERSC is evidenced by the demographics of its users and its portfolio of research projects. While university researchers have access to other computing centers, DOE laboratory researchers do not receive significant computing resources from other national centers.

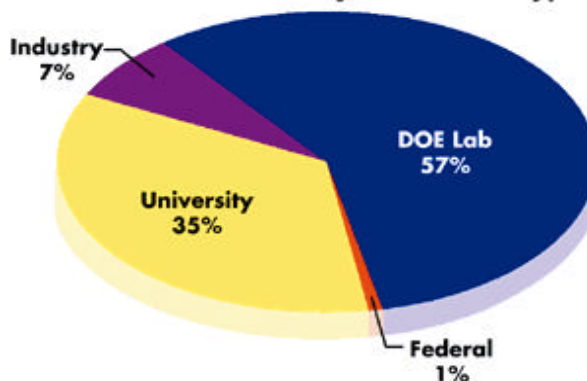
## **Who are NERSC's users?**

The community of NERSC users is drawn from both the DOE national laboratories and from universities. The large majority of users are funded by DOE, either by contracts with the laboratories or grants to university principal investigators. Roughly one-third of the usage is in universities, and a small fraction is by industrial collaborators of DOE researchers, as shown below for FY98. The university and laboratory fractions of computer time used at NERSC are mirrored by the relative numbers of users from those two types of institutions.

**NERSC FY 98 Usage by Institution Type**



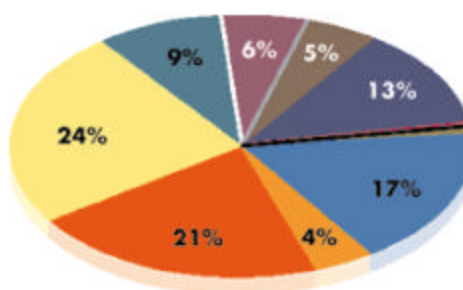
**NERSC FY 98 Users by Institution Type**



NERSC supports computing for the entire range of scientific disciplines funded by the DOE Office of Science. The relative proportions of the Center's resources used by those disciplines continue in FY00 to be close to that of FY98, shown below.



**NERSC FY 98 Usage by Discipline**



## Access to NERSC in FY00

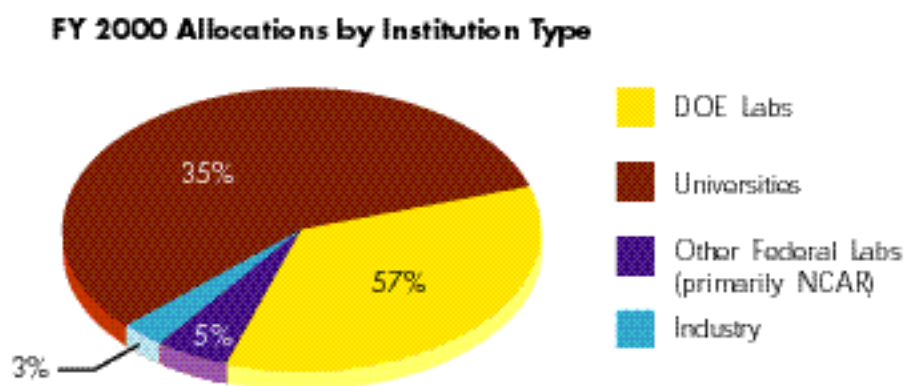
For FY00 the allocations process was reorganized to accommodate and balance two major needs of the Office of Science:

- the need for an open competition to allocate resources to the most important, challenging, and timely scientific opportunities, and
- the need to direct computing resources to collaborations or individuals in order to fulfill specific mission requirements of the DOE programs.

The details of the allocation process are described in the NERSC web site:

<http://hpcf.nersc.gov/accounts/allocations/>

The allocation process for each fiscal year is completed in September of the previous fiscal year. The allocations for FY00 continue to serve a broad community of university and laboratory users as indicated by the chart below.



## Access to other comparable centers

NERSC has served as a model for other national supercomputer centers which have been established over the past 15 years and continues as a national leader in terms of both services and systems provided to users and openness to the national research community. Here are examples of other leading centers and who may apply for computer time at them.

### National Science Foundation (NSF)

The NSF supports two centers with a mission similar to NERSC's. The San Diego Supercomputing Center (SDSC) at the University of California, San Diego, is the lead site for the National Partnership for Advanced Computational Infrastructure (NPACI). The National Center for Supercomputing Applications (NCSA) at the University of Illinois is the lead site for the National Computational Science Alliance. Each of these centers individually offers fewer resources than NERSC. The combined resources of both centers and their partners are allocated through a national allocation board. To apply for an allocation, a principal investigator must be a researcher or educator at a U.S. institution, defined as a 2-year or 4-year college.

Special rules apply for all others; in particular, NSF does not normally support research or education activities by scientists, engineers, or educators employed by Federal agencies or Federally Funded Research and Development Centers (FFRDCs). For more information, visit the web site at: <http://www.ncsa.uiuc.edu/alliance/applying/eligibility.html>

### **Department of Defense (DoD)**

Through its High Performance Computing Modernization Program (HPCMP), DoD funds four Major Shared Resource Centers (MSRCs) and 15 Distributed Centers.

The MSRCs provide computing resources of a similar magnitude to NERSC. They are:

- Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio
- Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi
- Army Research Laboratory, Aberdeen Proving Ground, Maryland
- Naval Oceanographic Office, Stennis Space Center, Mississippi.

Distributed Centers include:

- Air Force Air Armament Center, Eglin AFB, Florida
- Air Force Research Laboratory, Rome, New York
- Arctic Region Supercomputing Center, Fairbanks, Alaska
- Army High Performance Computing Research Center, Minneapolis, Minnesota
- Arnold Engineering Development Center, Arnold AFB, Tennessee
- Joint National Test Facility, Schriever AFB, Colorado
- Maui High Performance Computing Center, Kihei, Hawaii
- Naval Air Warfare Center, Aircraft Division, Patuxent River, Maryland
- Naval Air Warfare Center, Weapons Division, China Lake, California
- Naval Research Laboratory, Washington, D.C.
- Redstone Technical Test Center, Redstone Arsenal, Alabama
- Space and Missile Defense Command, Huntsville, Alabama
- Space and Naval Warfare Systems Command Center, San Diego, California
- Tank-Automotive Research, Development and Engineering Center, Warren, Michigan
- White Sands Missile Range, White Sands, New Mexico.

The basic eligibility requirement for using the HPCMP resources is computational research conducted by defense laboratories and Research, Development, Test, and Evaluation (RDT&E) centers within the military departments and defense agencies under the cognizance of the Director of Defense Research and Engineering and the Director of Test, Systems Engineering and Evaluation. University researchers with DoD research grants are also eligible.

### **NASA**

NASA maintains supercomputer centers at the Ames and Goddard research centers. Access to these centers is for NASA researchers in aeronautics (Ames) and earth and space sciences (Goddard). NASA has combined most of its high-end resources into a meta-center, with access limited to NASA-supported researchers.

*In summary, NERSC is the only U.S. supercomputer center which is available to DOE-funded researchers as well as researchers from other federal agencies and universities.*